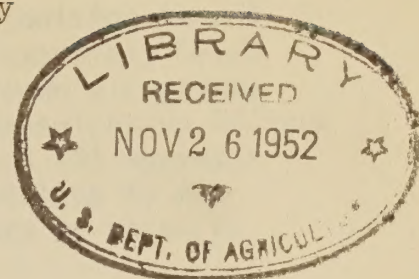


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G E N E R A L

The Bureau Research Council, composed of the Chief of Bureau, Assistant Chiefs of Bureau and the Directors of the four regions continued during the fiscal year 1952, as it has in the past to give consideration to broad problems affecting the Bureau's policies, research programs, organizations and administration. This device provides constant review of the Bureau's operations. Decisions reached at the Bureau Research Council meetings serve as a basis for action of the staffs at the regional level. This method of operation now only brings to light problems needing attention but forms a strong line of communication between top management and the field. Many examples of good management practice have been reported to the headquarters office in Washington. The following are a few selected examples which will serve to highlight the activities of the Bureau during the fiscal year 1952.

Highlights of Action Taken During the Past Fiscal Year

A. EXECUTIVE DEVELOPMENT

Improvement Activity - The Bureau received the benefit during the fiscal year of some of its long-range plans for executive development and training when it was able to fill three highly responsible positions in the Bureau from its pool of young executives whose potential worth was recognized years ago and who went through a series of developmental phases designed to equip them for high level positions.

A short case history of each of these three instances follows:

(a) During the fiscal year, there was added to the staff of the Assistant Chief of Bureau for Administration, a new position designated as "Administrative Officer" GS-14. The purpose of this position is to share with the Assistant Chief of Bureau for Administration the over-all responsibility for the administrative functions of the entire Bureau. The person selected to fill this position has a history of approximately ten years of training, development and grooming for the highly responsible job now held, having served (1) as Assistant Business Manager GS-9 for 3-1/2 years at one of the Bureau's regional research laboratories, (2) as Administrative Officer GS-11 for 3-1/2 years at the Bureau's headquarters office in Washington, D. C., and (3) as Business Manager GS-13 at another of the Bureau's regional research laboratories for nearly 3 years.

(b) The position of Business Manager GS-13 at one of the Bureau's regional research laboratories became vacant through retirement of the incumbent.

A well-trained successor was available to take over this position immediately. His background of development includes: (1) Approximately 6-1/2 years as Assistant Business Manager GS-9 at one of the Bureau's regional research laboratories, (2) approximately two years as Administrative Officer GS-12 at the Bureau's headquarters office in Washington and (3) approximately 1-1/2 years as Administrative Officer (Special Assistant to the Business Manager) GS-12 of the Regional Research Laboratory of which he is now Business Manager.

(c) With the filling of the GS-14 position in the Washington office as related in (a) above, the position of Business Manager became vacant at another of the Bureau's regional research laboratories. The Bureau was able to meet the need in this case by transferring a well-trained staff member from the Washington office headquarters. This employee's background includes (1) several years as an Administrative Assistant and approximately two years as Assistant Business Manager GS-9 at one of the Bureau's regional research laboratories and (2) approximately 1-1/2 years as Administrative Officer in the Bureau's headquarters office in Washington.

B. FISCAL OPERATIONS

Problem: With the activation of the four regional research laboratories, in 1940 the Bureau entered on an era of decentralization and delegation of authority to field staffs. In order to meet the needs of the Bureau under this new method of operation, a system of fund accounting was developed in cooperation with the General Accounting Office. This accounting system has been used during the past 12 years without major change. A comprehensive survey of the Bureau's fiscal operations was undertaken with a view to determining whether the system is adequate in the light of present-day activities and to take maximum advantage of existing management knowledge with respect to this broad field of activity.

Improvement Activity: As a result of cooperation between members of the Bureau staff the Department's Office of Budget and Finance and the General Accounting Office, a complete survey was made of the Bureau's fiscal operations. This not only included accounting operations but procurement and audit practices. Members of the survey group consulted frequently with the members of the staff of the Bureau headquarters in Washington to observe operations at the headquarters office and to receive the broad concept of the Bureau Management with respect to fiscal control from top officials. Survey teams also visited the regional research laboratories to gain first-hand knowledge of the Bureau's operations in the field. As a direct result of this survey and appraisal, the Bureau now has a valuable set of recommendations not only covering fund accounting but covering fields related to fiscal operations. One of the major recommendations was a proposal for the decentralization of the General Ledger accounts to the field. During the latter part of the fiscal year definite plans were made to decentralize this function early in the fiscal year 1953.

C. REDUCING COST OF RESEARCH BY COLLABORATION WITH INDUSTRY

Thrips in Cane Berries

Problem: An infestation of thrips in cane berries grown in the States of Oregon and Washington has presented a serious processing problem for berry packers and a vital economic problem for growers of this area during recent years. Investigation of this problem by research would have required difficult and costly collection of samples, careful arrangements for shipment, and special equipment installations to simulate commercial processing. This latter factor would require a sizeable commitment of research space, equipment and man power.

Improvement Activity: Arrangements were made through two large trade associations in the harvest area for conduct of the work in two farmers' cooperative berry processing plants. Utilization of these plants during normal seasonal processing operations made it possible to complete the investigations with the assignment of three members of the Bureau's research staff for a period of only two weeks. Not only was the man power requirement reduced to a fraction of that which would have been necessary if the investigations had been attempted at the regional laboratory; but also all equipment and shipping costs were eliminated. Since the thrip removal operations were conducted on both canned and frozen berries in a representative commercial plant, the research results have clear-cut applicability and have received immediate acceptance from the processors.

Freezing of Peas

Problem: A series of experiments were required on various phases of the freezing preservation of peas, designed to minimize or eliminate loss of nutrients and flavor substances during blanching. Conduct of the entire investigation would have involved costly and difficult air express shipment of raw material from the growing areas in Oregon and Washington. It would have then been necessary to tie up a substantial portion of the laboratory's food processing equipment and to assign a force of ten to fifteen staff members to the project for a period of approximately one month.

Improvement Activity: Arrangements were made to conduct the investigations at a representative pea freezing plant located in a major harvesting area in Oregon. Two chemists were assigned to the problem, which was then completed in less than one month. Since the Government's financial outlay was limited to the salaries of these two workers and minor incidental expense of travel, the cost of the research was only a fraction of that which would have been incurred if the work had been conducted at the regional laboratory. In addition, facilities and man power at the laboratory were kept available for application to other urgent problems.

Tomato Wastes

Problem: Pilot-plant research on the utilization of tomato wastes requires large quantities of the perishable commodity. Facilities were not available to process these quantities prior to the mixing and drying operations without spoilage. Hence, it was necessary to obtain the press cake and have the waste liquors concentrated elsewhere.

Improvement Activity: Through conferences between Bureau members and officials of a large Eastern cannery, plans were developed whereby they supplied at no cost, about 18 tons of press cake, 7 tons of waste liquor, and concentrated about 18 tons of waste liquor to produce about 3 tons of concentrate of 30 per cent solids. They also furnished data on the quantities of the several wastes as they normally occur and their solids contents. These data were of great value in making an economic analysis of the process of disposal which was developed.

Volatile Flavor Concentrates

Problem: Preliminary experiments in the pilot plant had shown that volatile flavor concentrates, i. e., essences, of good quality and high potency could be recovered from the vapors given off from vacuum preserve kettles. To have carried research in the pilot plant far enough to obtain basic engineering data for industrial use and cost estimation would have required the outlay of large sums for the purchase of fresh or frozen fruits and for equipment in which to process them to preserves. Since this Laboratory was not studying preserve manufacture and was concerned only with recovery of a byproduct from such operations, it would not have been practical for it to install preserve kettles and the necessary auxiliary equipment for condensing and accumulating all of the aroma-containing vapors, in order to study the problem.

Improvement Activity: By the use of a surface condenser, a receiver, vacuum pumps and other equipment already existing, facilities were assembled for withdrawing and recovering an amount corresponding to about one-quarter of the vapors given off from a preserve kettle. Through the cooperation of a commercial firm, these facilities were installed in a nearby plant. In consequence, there were obtained within a few months time sufficient quantities of preserve condensates from a variety of fruit preserves to permit the study of essence preparation from these condensates. Limited but valuable quantities of strawberry preserve essence were prepared for industrial evaluation. Sufficient data were obtained to prepare a final publication on essence recovery during preserve manufacture. The publication will include engineering data as to the auxiliary equipment required and an estimate of the cost of commercial operation. This work was done without the expenditure of any funds for additional equipment or for the purchase of raw materials. By cooperation, a large saving in equipment and supplies was effected, and the progress of the work speeded up materially.

D. IMPROVED TECHNIQUES AS AIDS IN SOLVING RESEARCH PROBLEMS

Use of Machine Calculators

Problem: In conducting a research investigation in which the single fiber stress-strain properties of wool from five distinct breeds of sheep were being evaluated, it was soon discovered that to establish significant differences the methods of statistical analysis needed to be employed. A rough calculation established that fact that obtaining the maximum amount of information available in the data would require, for multiplication and division alone, in the order of a quarter of a million entries utilizing the most suitable type of electric desk calculator. Additions would require a similar number of entries. It was therefore readily apparent that if the data were obtained in this fashion, approximately six months of one staff member's time would be required for the purpose which not only represented an undesirable expenditure of man power but also imposed a serious delay in obtaining the desired data.

Improvement Activity: Facilities for mechanical analysis were investigated and found to be available. The primary data were then sent to a computing establishment to be entered on punched cards and processed through automatic business calculators following a well-designed pattern devised by the research project leader. In a few days and at a fraction of the cost which would have resulted from hand calculation of the data, the special computing machines performed operations which would have taken at least six months utilizing ordinary equipment. This made it possible to analyze the data thoroughly. A valuable byproduct of this comprehensive analysis was the finding that several of the physical tests, themselves time-consuming, have only insignificant importance. They can, therefore, safely be eliminated from future studies.

Identification of Acids in Sugar Beets

Problem: When a research project in identification and determination of the organic acids in sugar beets was started, the classical approach of fractional precipitations with calcium and barium salts and organic solvents was used. In a few months it was apparent that years would be required to identify the acids present and quantitative determinations would be equally time-consuming.

Improvement Activity: Ion exchange and another newly developed analytical technique, paper chromatography, which had been found to have notable success in other phases of the Bureau's nation-wide program and thus had been reviewed at high levels for applicability to other problems, were then applied to this problem. The development of the methods and analysis of eight sugar beet processing liquors were then completed in one year. Notwithstanding these improvements, it was considered essential to speed up the work. Attention was given to utilization of the most modern laboratory equipment, and as a result, an automatic sampler was secured and a second sampler was constructed by the

Laboratory's shops with modifications to the commercial design to fit the specific problem. As a result, it became possible to analyze eight sugar beet liquors for the organic acids in a period of two months. The saving in time and money by use of modern equipment and techniques is almost incalculable. Without them the problem would have been impossible on the scale necessary to obtain useful results. With them the problem is routine and leaves ten months of the year for investigation of other problems for the sugar beet grower and processor.

Seeking Sources of the Drug Cortisone

Problem: In its research on the possible plant sources of the drug cortisone, it was necessary to screen a large number of plant samples for the presence of compounds known as sapogenins, some of which can be used for the manufacture of that drug. The purpose of this screening is to obtain a rough estimate of the total amount of mixed sapogenins in each plant and to identify the major component of the sapogen mixture. The classic chemical method requires repeated chromatographic separations and recrystallizations before the sapogenins are sufficiently pure to be identified by means of melting points, optical rotations, etc. This procedure would require the time of a chemist for several weeks to analyze each plant sample.

Improvement Activity: An examination of the infrared spectra of the sapogenins occurring most frequently in plants revealed that each sapogenin had a highly characteristic infrared spectrum. In fact, the spectra of the sapogenins were so pronounced that the sapogenins could be identified in the spectra of crude plant extracts without the necessity of separation or purification. All that is required is that the plant extract be hydrolyzed to set free the sapogenins, followed by a brief extraction and acetylation. The infrared spectrum of the crude acetate is then obtained with an automatic infrared spectrophotometer. From the absorption of one wave length of this spectrum the total amount of mixed sapogenins can be calculated. By comparing the spectrum with a file of spectra of the most common sapogenins, the major component of the plant extract can be identified. One chemist can do the preliminary chemical preparation on about ten plant extracts per 40-hour week. One infrared operator can produce about ten of the spectra per 8-hour day, including the calculation of the results. Use of this screening procedure has made it possible to examine over a thousand plants per year, whereas classical chemical methods would have limited the examination to a few hundred per year. The search for plant sources of compounds suitable for conversion to cortisone has thus been greatly speeded up by use of this technique.

Postmen Test Shoes to Determine Wearing Quality of the Leather

Problem: In the course of research aimed at the development of canaigre as a domestic source of tannin it became necessary to establish whether or not canaigre tannin can effectively replace other tanning in making sole leather.



The object of the research is to develop a suitable domestic source of vegetable tannin so the United States will not be completely dependent on imports. Laboratory analysis and the subjection of experimental leathers to physical tests in the laboratory gave valuable data, but these do not necessarily correlate with or indicate what actual service may be expected. It is necessary therefore to make this determination by actual wear tests.

Improvement Activity: To meet the situation cooperation with several local post offices was obtained and arrangements made for testing the shoes by postmen who are wearing them on their daily rounds in order to determine the wearing quality of the leather. Postmen were selected because they walk many miles a day over pavements, gravel, macadam, and dirt roads, and in all kinds of weather. Sixty-eight pairs of shoes are being tested in this way, each pair being made to an individual postman's measurement, and worn by that postman continuously until the soles have worn thin. When a sole has worn thin, the pair of shoes is returned to the Laboratory for resoling. In each case the sole of one shoe is made of canaigre-tanned leather and the other of leather tanned by the usual tanning materials. Through arrangement of this cooperation, the progress of the research on developing canaigre as a domestic source of tannin has been greatly accelerated.

Device for Measuring Length of Fibers

Problem: The use of the Fibrograph for measuring the length of fibers in a sample of cotton normally requires close attention by the operator in the manipulation of two handwheels in such a manner as to maintain balance on a glavonometer. The repetition of this manipulation, which takes from 2 to 5 minutes for each determination, is fatiguing to the operator.

Improvement Activity: A simple method requiring virtually no change in the Fibrograph was developed for converting the instrument to automatic operation by the use of a rugged electrical device described as a servo system. With this accessory, smoother fibrogram curves are drawn by the instrument and the personal equation of the determination is minimized. A single operator can perform 60 per cent more tests because he is free to comb the next test sample while the curve of the previous sample is being drawn.

Determining Uniformity of Sliver, Roving and Yarn

Problem: The Uster tester is a commercial electronic instrument used to determine the uniformity of sliver, roving, and yarn in terms of changes in weight per unit length. Two distinct methods of measurement are involved -- the Integrator method and the chart-analysis method. Each method involves a number of manual manipulations requiring close attention of the operator -- a tedious and time-consuming operation. The instrument requires a warm-up period -- another factor contributing to inefficiency. Uniformity measurements are necessary as a guide in developing cotton products of improved strength,

appearance, and serviceability, and also in the improvement of processing efficiency at the various processing steps.

Improvement Activity: To facilitate the reading of the Integrator, a buzzer system was developed by which the operator can select the desired time interval for a specific test. Since the buzzer sounds at the proper time, the interval between readings can be used for chart analysis. To eliminate the continuous movement of the chart, a chart movement regulator was developed which stops the chart for a certain percentage of each minute, during which time the recorder pen continues to function. This automatically divides the chart into specified lengths and facilitates the reading of the high and low points. An added feature of the development is the fact that only half as much paper is used as formerly. A comptometer was obtained from surplus property to eliminate the hand recording of high and low points on the chart. A touch system was developed which allowed the operator to keep her eyes on the chart while depressing the proper keys on the comptometer. This resulted in a significant decrease in time formerly required for analyzing the charts. Since the length of paper corresponding to an entire test series is usually over 50', a winder was constructed by which the operator can wind up a section of chart as soon as the analysis is completed. The automatic winding and re-winding at the completion of a test series is many times faster than the same operation by hand. A time switch was installed so that the machine would be turned on automatically three to four hours before working time. In this way the machine can be used for immediate testing as soon as the operator arrives.

Extraction of Oilseed

Problem: The development by the Bureau of a new type of solvent process for extracting cottonseed oil has attracted wide interest among oilseed processors and equipment manufacturers. The new process is known as filtration-extraction because of the principle employed in its operation. To determine whether cottonseed, or any other oilseed prepared in a certain manner, can be extracted efficiently by the new process, a great deal of engineering and processing data are needed. The problem with each oilseed is to obtain as much as possible of this information on a small scale and avoid costly experimental runs on a pilot-plant scale.

Improvement Activity: A bench-scale technique devised in the development of the new process for cottonseed consists of subjecting cottonseed meats to various preparation operations of rolling and cooking and then carrying out the ensuing solvent operations of mixing, filtering, washing, and solvent removal. Only a few pounds of prepared cottonseed meats and solvent are needed. The principal units used are a mixing container of about 5-gallon capacity and a filtering crock or container about one foot in diameter in which the filter medium is in a horizontal position and variable suction is applied from below. With this equipment it is possible to determine in a preliminary manner, the effect of preparation, mixing or slurring time, solvent-to-meats ratio, filter-bed thickness, type and weave of filter medium, temperature, particle

size and distribution, filtration and washing cycle, "blowback" or other means of clearing the filter medium, and other variables, on extractability, filter capacity, residual oil content of extracted meal and on product quality. With this basic processing information serving as a guide, only a relatively few large-scale continuous, pilot-plant runs have been needed to confirm and check the preliminary data, to provide larger quantities of products for evaluation purposes, and to obtain engineering data on continuous operations. Thus, for each new oilseed being studied, including rice bran, peanuts, tung, soybeans, and flax, there is saved the expense of procurement and processing of several tons of material and many man-weeks of research effort. These savings and the further expediting of the research are continuing as the project progresses.

E. ORGANIZING TO IMPROVE ATTACK ON RESEARCH PROBLEMS

Consolidation of Fruit and Vegetable Work

(1) Problem: Since the establishment of the Bureau's Eastern Regional Research Laboratory the potato research work has been assigned to the Division investigating carbohydrates, of which potatoes are a principal source. The remainder of the research on fruit and vegetables has been conducted by the Division dealing with biochemistry. However, due to changes and modifications in the research program to meet the present-day situation the lines of investigation pursued by these two groups have grown closer.

Improvement Activity: After a careful study of present and future research activities it was determined that the consolidation of the two research teams into one Division, to be named the Fruit and Vegetable Division, would materially improve the Laboratory's program. The following advantages are anticipated from this reorganization of the Laboratory's staff:

(1) While each fruit and vegetable presents its own individual problems, the methods of attacking them are often quite similar, and analytical methods identical. Under this reorganization the work will be supervised by one Division Head instead of two.

(2) Closer cooperation between the technical men working on related subjects will permit the exchange of ideas which will be helpful in solving the problems at hand.

(3) There will be economy in equipment. The various groups working on related subjects and located immediately adjacent to each other can easily arrange to use the same equipment at a time convenient to all concerned.

(4) There will be an over-all economy in utilization of personnel because identical work can be quite often done by one worker for several groups at the same time.

(2) Problem: To improve the efficiency of utilization research on Southern-grown fruits and vegetables.

Improvement Activity: A new Fruit and Vegetable Division was formed during 1952 fiscal year in the Southern Region of the Bureau. The new Division is composed of a Biochemical Section in New Orleans, Louisiana, and three field stations: U. S. Citrus Products Station, Winter Haven, Florida; U. S. Fruit and Vegetable Products Laboratory, Weslaco, Texas; and U. S. Food Fermentations Laboratory, Raleigh, North Carolina. Units of the Division will concentrate their respective activities on commodities which are in high production in the areas in which they are located. The existence of the new Division facilitates program readjustments to meet the changing research needs in different areas. For example, the citrus industry is expanding in acreage and production in Florida, but in Texas it has received a severe setback as a result of crippling freezes. Although Texas farmers are replanting orchards in the Rio Grande Valley, a profitable fresh market vegetable industry has developed. As a result the emphasis in research at the Weslaco Station has shifted to provide information on canning of vegetables which are surplus to the fresh market demand. In revising the Division's research program full use was made of the recommendations and priorities for expanded and new researches on utilization as set forth in the latest reports of the Department's Vegetable and Citrus Fruit Advisory Committees.

Coordination of Research on Oils and Meals

Problem: The coordination of phases of research on the oils and the meals obtained in processing Southern-grown oilseeds.

Improvement Activity: A new Oilseed Division was formed in the Bureau's Southern Laboratory in 1952. It was made by merging the Oil and Oilseed Division, a portion of the Protein and Carbohydrate Division, and the Bureau's U. S. Tung Oil Laboratory at Bogalusa, Louisiana. The Bureau's Southern Laboratory has pioneered in research that demonstrated the possibility of processing cottonseed in a way to obtain a meal of improved nutritive value. Since the principal economic product of cottonseed is the oil, any change in processing that increases the value of the meal but lowers the quality of the oil may not benefit the industry. In the processing research consideration is therefore given to the effect of processing conditions on the quality of both the oil and meal. The coordination of this work is facilitated by the new arrangement.

F. IMPROVED MANAGEMENT IN OPERATION OF PHYSICAL PLANTS

Distilled Water Requirements

Problem: Approximately 100 individual laboratory rooms at one of the Bureau's laboratories require services such as vacuum, gas, and distilled water which are supplied from central sources to the individual laboratory benches. Requirements for distilled water have been supplied for the past several years from

two steam operated stills, each of which produced 20 gallons of distilled water per hour. The increased level of research activity made this supply inadequate and the problem was further aggravated because the stills had reached an age where their operating efficiency was poor. Normal operation of each still involved a check by the operating engineer on every hourly tour, and in addition required a weekly cleaning of the boilers. This cleaning operation was a half-day job for two men.

Improvement Activity: The incidental potentialities of a new steam plant in the Food Processing Laboratory were carefully surveyed, and it became apparent that a steam condenser for the reboiler in this plant was producing distilled water which could be utilized by the entire Laboratory instead of being disposed of as sewage. A simple pumping and distribution system was devised, and a thoroughly adequate supply of distilled water for all present and foreseeable needs was thereby created. This action obviated the need for replacement of the old stills, and eliminated the maintenance work previously necessary in their operation.

Warehouse Operation

Problem: A separate warehouse was put into operation about three years ago at one of the Bureau's regional research laboratories, and, although definite space assignment and usage were defined at the time, it has become increasingly apparent that a more centralized, direct management of the warehouse was needed to assure good usage of these facilities, as well as to provide for maximum utilization of Government equipment and supplies.

Improvement Activity: A three-member Warehouse Management Committee was appointed to study this problem and to formulate plans to achieve the following objectives: (1) To effect, as soon as possible, a thorough clean-up and to dispose (through the Board of Survey) of all items now in the warehouse for which clear-cut need cannot be established; (2) to improve the usefulness, general appearance, and safety of the warehouse, and (3) to maintain the warehouse in proper condition. A plan has been initiated that retains the primary responsibility for operating the warehouse in the hands of the Divisions using the facilities, and at the same time provides for inspection by the Warehouse Management Committee to see that the facilities are properly used and maintained. The record-keeping has been minimized and streamlined. A definite system for tagging as to the identity and useage of all items, bins, and spaces has been adopted. Improved space arrangement and operating procedures are being installed. As a result of these improved management procedures, more efficient utilization of our equipment and supplies will be attained, the general appearance and safety of the warehouse will be materially improved, and the disposal of surplus property will be considerably simplified and expedited.

Major Areas Of Potential Improvement Selected For Emphasis
During The Current Year

A. Improvement in Fiscal Operations: The recommendations obtained as a result of the accounting survey carried out cooperatively with the Office of Budget and Finance and the General Accounting Office will be given careful consideration and as many of the recommendations will be put into effect as is practicable. The decentralization of the General Ledger Accounts has been virtually completed so far during the current fiscal year.

B. Reorganization and Reassignments: Close attention will be given to the structure and program of the various units of the Bureau with a view to organizing the resources of the Bureau to make the best attack on the problems at hand. For instance, plans are already under way to transfer the Biologically Active Chemical Compounds Division from its present headquarters at Beltsville, Maryland, to Philadelphia, Pennsylvania, where it will become a part of the Bureau's Eastern Regional Research Laboratory. This change will not only result in a better contribution to the Bureau's research program but will make available to the Division facilities which it has not had heretofore such as: pilot-plant, extensive analytical laboratories and a complete technical library.

At the moment there is under consideration a plan for a new tannin research section to give attention to much needed fundamental studies on the structure reactions, and possible modification of vegetable tannins and a study of the possible modification and improvement in leather properties.

C. Reduction of Sewage Disposal Costs: The Bureau's Western Regional Research Laboratory uses approximately 11,000,000 cu. ft. of municipally supplied water per year in meeting the requirements in pilot-plant and food-processing work, normal laboratory operations, steam generation, and grounds irrigation. Very recently local municipalities formed a sewage district and built a plant to process raw sewage which had previously been dumped in untreated condition into San Francisco Bay. Charges are made on a service-rendered basis for actual quantities of water purchased and therefore presumed to become sewage. Based on current operations, the annual cost to the Bureau is in the neighborhood of \$5,000 per year.

As a result of preliminary negotiations with the utility company, it is planned to install separate meters on the water supply line to the grounds irrigation system, and to other equipment such as steam ejectors which vent clean water disposal in the storm lines. This separation of water usage should appreciably reduce the sewage disposal and the utility company has indicated its willingness to make a deviation from its formal published rate schedules to suitably reflect data established by the proposed metering and thus materially reduce the billing for this service.

Incidental to installation of this metering system, careful consideration will be given to the possibility of storing waste clean water from steam ejectors

for use in irrigation of the laboratory grounds. Since the local climatic conditions make irrigation necessary for several months a year, this step, if otherwise practicable, should result in material reduction of water cost.

